AD-A143 730 SECTION 32 PROGRAM STREAMBANK EROSION CONTROL EVALUATION AND DEMONSTRATIO..(U) ARMY ENGINEER WATERWAYS EXPERIMENT STATION VICKSBURG MS HYDRA.. 1/1

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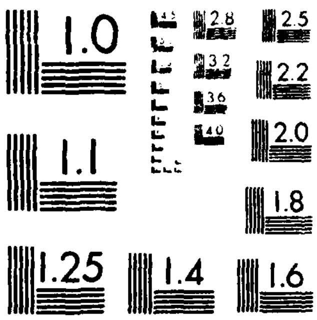

MICROCOPY RESOLUTION TEST CHART
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AD-A143 730

SECTION 32 PROGRAM
STREAMBANK EROSION CONTROL
EVALUATION AND DEMONSTRATION
WORK UNIT 3-HYDRAULIC RESEARCH

BANK PROTECTION TECHNIQUES USING GABIONS

by

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SECTION 32 PROGRAM

STREAMBANK EROSION CONTROL EVALUATION AND DEMONSTRATION

WORK UNIT 3 - HYDRAULIC RESEARCH

BANK PROTECTION TECHNIQUES USING GABIONS

1. A series of tests was conducted at the U. S. Army Engineer Waterways Experiment Station (WES) to evaluate the effectiveness of several schemes of using gabions for bank protection. Specifically, efforts were directed at evaluating the use of gabions for hard points or toe protection similar to the way riprap is used for hard points or toe protection at several prototype sites in the Vicksburg District.

2. The facility used in the tests is shown in Photo 1. The channel had a 5-ft bottom width, 1V-on-2H side slopes, and a depth of 0.8 ft. The test section in the channel was a 30° bend with a radius of 22.5 ft. A point bar was molded in the bend to concentrate the flow on the outside bank of the bend. The bend was preceded by a 40-ft-long straight reach having the same cross section. All test channels were molded in sand having a median diameter of 0.45 mm. Although no sand was fed at the entrance of the flume, the test section received substantial bed load due to scour in the straight reach preceding the test section.

3. Each design was tested at a series of runs with increasing discharges while the depth of flow was held constant at 0.5 ft. This resulted in an increase in the average stream velocity and total duration of exposure to flow. The ratio of depth of flow to material size was 340. Model discharges, time steps, and resulting average velocities were as follows:

Run No.	Q cfs	Time hr	Average Velocity fps
1	2.0	0- 4	0.67
2	2.5	4- 8	0.83
3	3.0	8-12	1.00
4	3.5	12-16	1.17
5	4.0	16-20	1.33
6	4.5	20-24	1.50

Photographs were taken before run 1 and after run 6.

4. The first test was conducted without any bank protection in order to establish a base condition with which to compare various

protective methods. The before-flow condition is shown in Photo 1 and the results after run 6 are shown in Photo 2. The unprotected channel experienced considerable erosion and became wider and shallower as a result of the flow.

5. The first protection tested was a series of gabion hard points connected with a row of gabions at the toe of the channel side slope. The gabions were wired together and the gabion hard points were anchored with cables at top of the bank. The approach channel and test section with gabions before flow are shown in Photo 3. The approach channel was protected with riprap toe protection to prevent excessive erosion of the channel banks. The test section with gabions in place and anchored is shown in Photo 4. The gabions were spaced at intervals of 1.6 ft (2 × bank height) at the beginning of the curve. The spacing was reduced to 1.2 ft (1.5 × bank height) in the area of maximum attack and increased to 1.6 ft downstream of the channel bend. This protection after run 6 is shown in Photo 5. The model gabions were not as flexible as they would be in the prototype, resulting in the "bridging" shown in Photo 5. This scheme of protection might be more effective if two or three rows of gabions were used instead of one for both toe protection and hard points.

6. The second protection tested was another series of gabion hard points spaced at greater intervals than in the first test series. The test section with gabions in place and anchored with cables to top of the bank is shown in Photo 6. The gabion hard points were spaced at intervals of 3 ft (3.75 × bank height) at the beginning of the curve. The spacing was reduced to 2 ft (2.5 × bank height) in the area of maximum attack and increased to 3 ft downstream of the channel bend. This protection after run 6 is shown in Photo 7. The greater spacing of the gabion hard points resulted in more severe erosion.

7. The third protection tested was a "toe protection only" scheme with four rows of gabions laid along the toe of the channel bank as shown in Photo 8. This protection after run 6 is shown in Photo 9. Because sand was used in the model bank, severe erosion took place on the upper bank. However, the gabions were effective in maintaining the integrity of the material at the toe of the channel bank and might work well in the prototype if the upper bank can withstand the infrequent attack that occurs during high runoff events. The upper bank stability would depend upon soil cohesiveness, vegetation, etc.

8. An innovative protection method similar to the "toe protection only" has been used on Antelope Creek and Dead Man's Run in Lincoln, Nebraska, by the Lower Platte South Natural Resources District. Both of these are major drainage channels located within the metropolitan area of Lincoln. A typical cross section illustrating the technique is shown in Figure 1.

9. No attempt was made to establish definite scale relations for use in these tests. This was because the ratio of depth of flow to material size was different in model and prototype and because of the problems involved in relating the rate of erosion of a model with sand bottom and bank to the rate of erosion of a prototype having bottom and bank with different characteristics. Therefore, no spacing for the gabion hard points or design velocities were determined from these tests. These tests were intended to demonstrate certain bank protection measures having the potential for low cost rather than to determine specific design criteria. The effectiveness of different hard-point spacing and flow velocities can be evaluated from specific prototype demonstration sites (existing or future). Gabion protection may be used as shown in WES TR H-75-19, "Fourmile Run Local Flood-Control Project; Alexandria and Arlington County, Virginia," in urban areas and where total bank protection is required.

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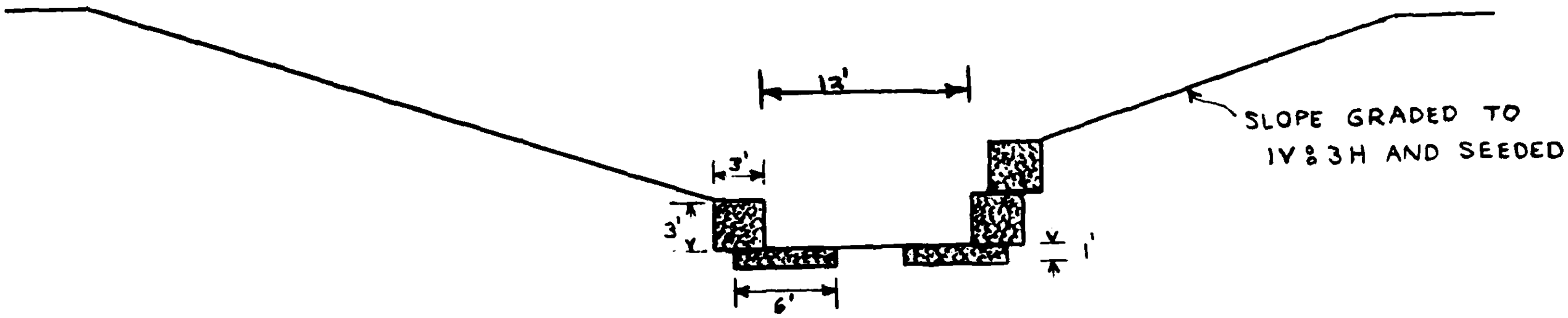

Figure 1. Typical cross section of Antelope Creek and Dead Man's Run, Lincoln, Nebraska

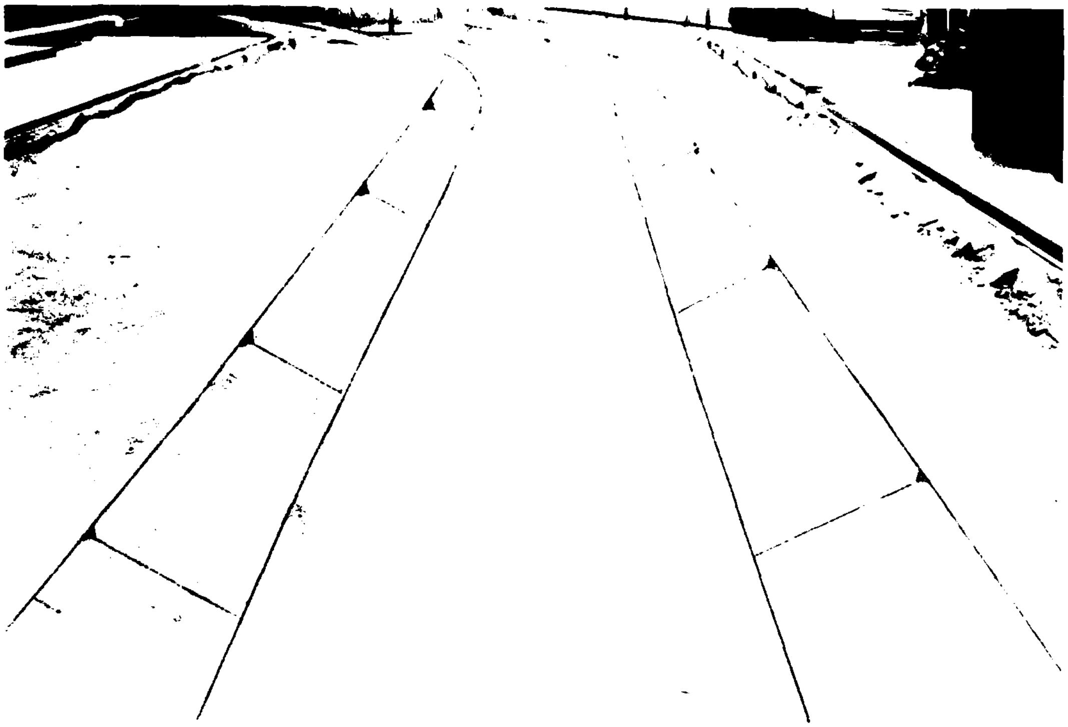

Photo 1. Test facility

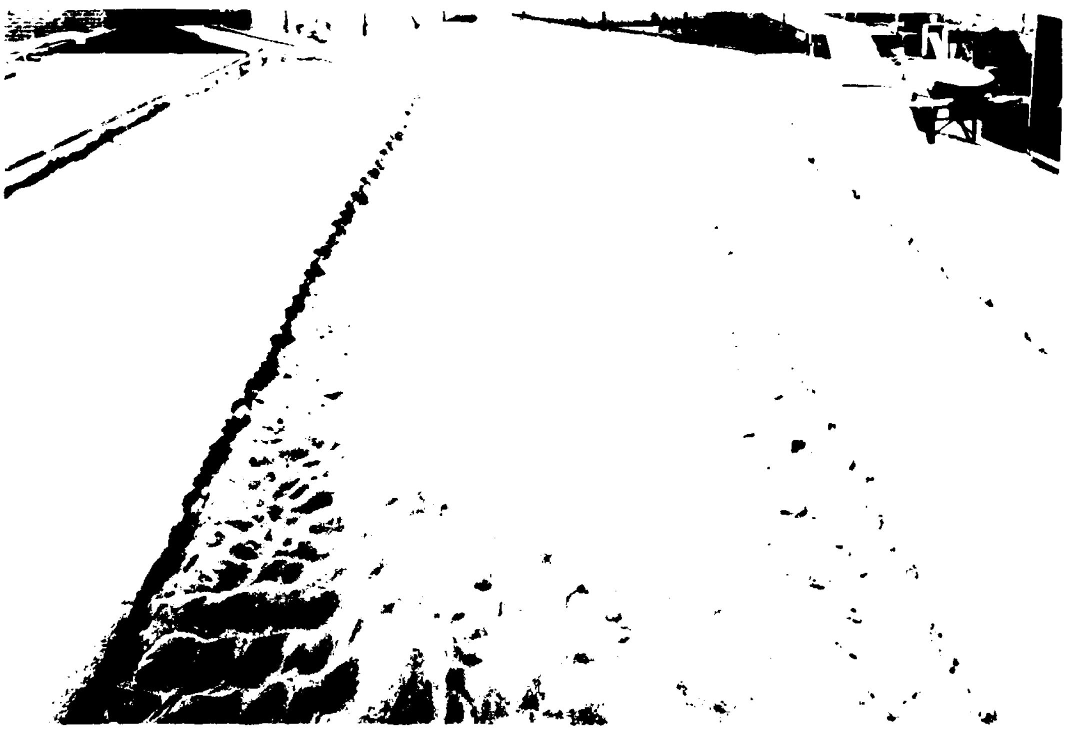

Photo 2. Erosion of unprotected channel

Photo 3. Approach channel and test section with gabions before flow

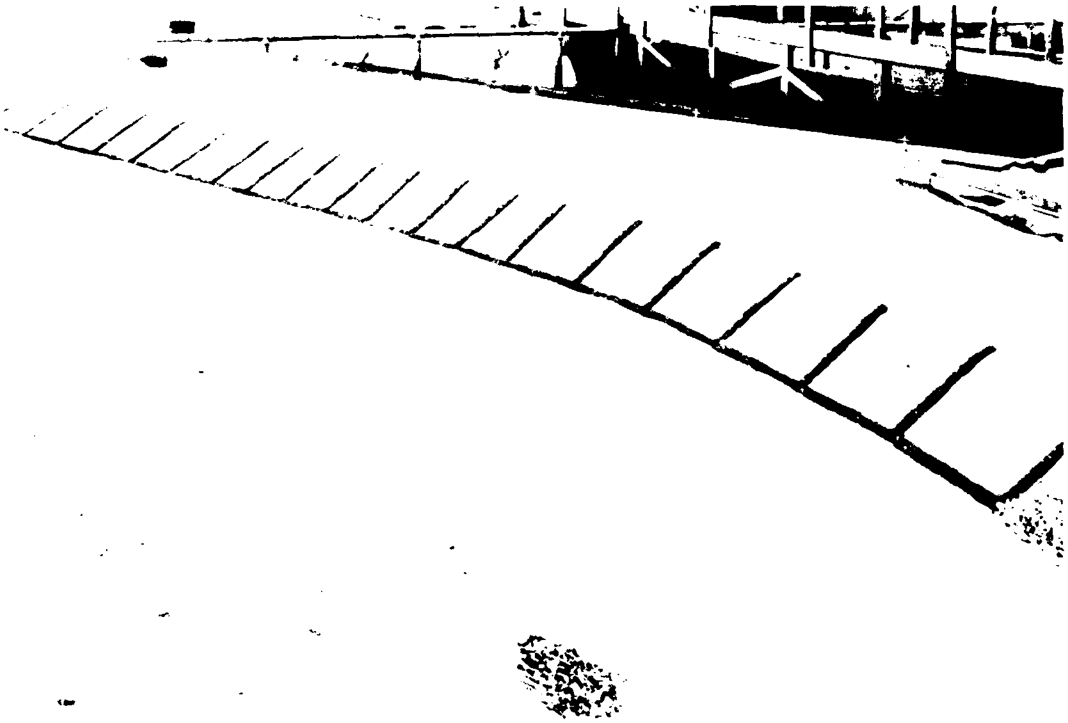

Photo 4. Gabion hard-point protection No. 1, before flow

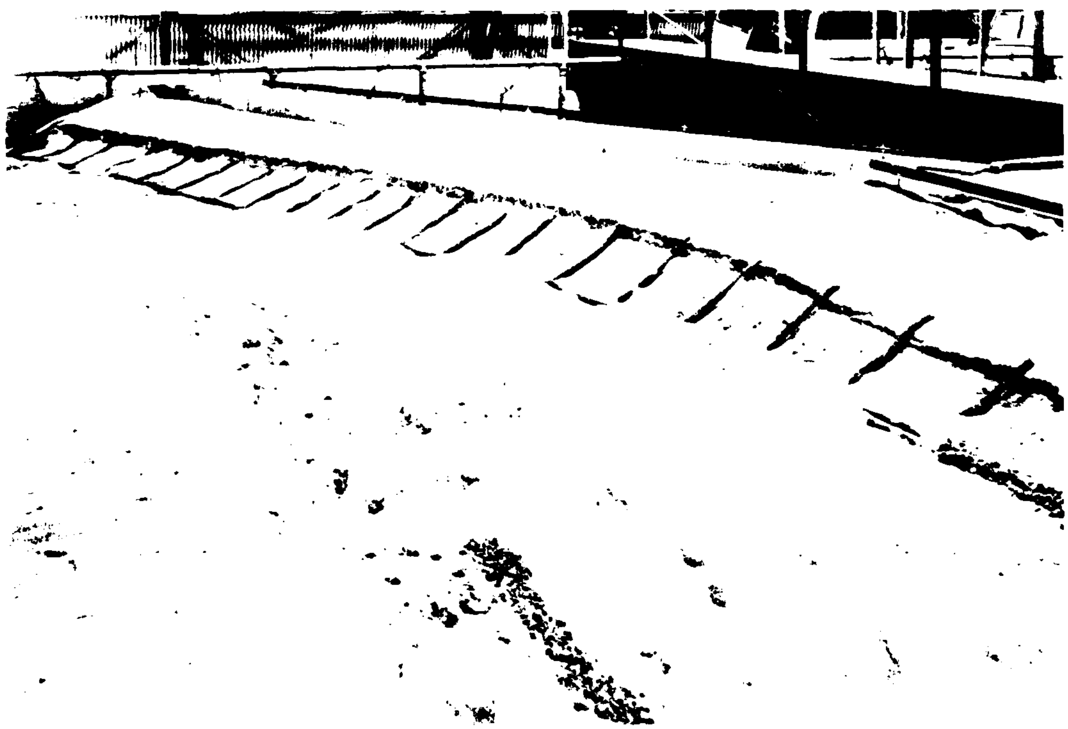

Photo 5. Gabion hard-point protection No. 1, after flow

Photo 8. Gabion toe protection before flow

Photo 9. Gabion toe protection after flow

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